The year in science

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Planetpalooza Its name doesn't exactly roll off the tongue, but HD 189733b is the planet of the year. A gas giant orbiting a yellow dwarf star roughly 63 light years away. HD 189733b is the first exoplanet—short for extrasolar planet—for which astronomers have been able to produce a weather map. That map was created in May by a team led by Heather Knutson at Harvard University.

Culled from infrared spectrographic data captured by NASA's Spitzer Space Telescope, the weather map shows that the atmosphere of HD 189733b is riven with supersonic winds and has highs of around 1,700 degrees Fahrenheit. The planet appears to be too hot and violent to support anything like life as we know it, but now that astronomers know how to study the atmosphere of one exoplanet, they are ready to try extending the technique to other, potentially more inviting worlds. "This is not something we thought we'd be able to do for 10 or 20 years," Knutson says. "It's exciting to see if we can do it for smaller planets." [Steven Ornes]

Arctic thaw On August 2, a pair of 18-ton Russian submersibles, *Mir-I* and *Mir-II*, plunged more than two miles down into the Arctic Ocean and planted a titanium capsule containing their nation's flag on the seabed at the North Pole. Russian parliamentarian and explorer Artur Chilingarov, who rode in the first of the two minisubmarines to reach the ocean floor, declared, "Our task is to remind the world that Russia is a great Arctic and scientific power," to which Canadian foreign minister Peter MacKay retorted: "This isn't the 15th century. You can't go around the world and just plant flags and say, 'We're claiming this territory!'" The posturing is part of a deadly serious race. As the melting of the Arctic sea ice accelerates, countries with claims on Arctic Circle territory—including not just Russia and Canada but also the United States, Denmark, Norway, Sweden, Iceland, and Finland—are scrambling to send mapping expeditions to the icy North. Within days of the twin *Mir* descent, the U.S. Coast Guard had dispatched the icebreaker Healy north of Alaska to spend nearly a month mapping the Arctic Ocean's floor; Canada commenced a 10-day military exercise called a "sovereignty operation;" and the Danes sent scientists to map the seabed north of Greenland. The prizes are not just the much-vaunted oil and gas reserves that lie beneath the Arctic but also access to the Northwest Passage, a shipping route between the West and Asia across the Arctic that year-round ice packs have long made impassable. If the Northwest Passage were to open, the route from London to Tokyo would be 3,000 miles shorter than the one trough the Suez Canal. [Josie Glausiusz]

Conservation's green light As the debate about the pros and cons of biofuels drags on —biofuels could end up in the atmosphere as nitrous oxide, a potent, long-lived greenhouse gas—, other remedies are taking shape, Corporations are beginning efficiency programs, clean technologies are snagging billions of venture capital dollars, and investment in sustainable products is on the rise. Plus, there is already a large consumer market for energy-saving items such as hybrid cars and Energy Star appliances. Even a simple flick of the switch could bring startling savings. According to the Alliance to Save Energy, new standards for efficient lighting could save 158 million tons of carbon emissions each year, the equivalent of the emissions from 80 coal-fired power plants. Common fluorescent light bulbs, for example, use 75 percent less energy than standard incandescents and last ten times as long. If the bulbs were adopted world wide, that single measure could meet 70 percent of the additional carbon reductions promised by industrialized nations in the Kyoto Protocol. [Samir S. Patel]

How hurricanes influence climate In May, a team of researchers announced that hurricanes play an under-appreciated role in how heat is regulated in the oceans. Their study adds to the existing model of heat dispersion in which water cools as the Gulf Stream moves toward the North Atlantic, becoming denser and eventually sinking below the surface. This creates a deep underwater current of cold water that flows south, finally surfacing in the Indian, Pacific, and Southern Oceans. However, in their wake, hurricanes set up large amplitude waves that mingle warm surface water with colder deep water; such mixing could account for up to 15 percent of the heat transport in the oceans. Hurricanes have such an impact because they occur in the tropics, where the temperature difference between the surface water and the underwater current is greatest. Because a hurricane cools surface water, it discourages the formation of later storms in its wake, providing a form of negative feedback that limits the hurricane merging effect. Although that may end up warming, not cooling, oceans, we may reach a point, with rising water temperatures from global warming and mingling, where we will have gotten rid of the cold water to mix up. At that point the blending might produce warmer temperatures—and even stronger storms. [Sarah Webb]

First step to wireless electricity Thanks to wireless technology, rechargers could become a thing of the past. In July, researchers at MIT extended the Wi-Fi concept to allow the beaming of power to anything that uses electricity. Freeing electrical transmission from power lines has been a dream since the days of pioneering electrical engineer Nikola Tesla. Today electricity can be transmitted via magnetic induction in such things as security swipe cards. But sending electricity this way is practical over only the smallest of distances. The MIT Wi-Fi power demonstration uses two precisely tuned coils to boost efficiency. Power is loaded into one large coil a couple of feet in diameter, causing electricity to surge back and forth more than a million times a second. These pulses of electricity create a flickering magnetic field that passes over most objects, except the powered coil's mate (which can be made small enough to fit into consumer electronics). The mate strongly resonates with the magnetic field, inducing electrical surges that can be tapped to recharge a cell phone or power a computer. [Jeffrey Winters]

248-dimensional math problem solved One hundred twenty years after it was first discovered, mathematicians have successfully mapped out a 248-dimensional object called E_8. The complete description of E_8—one of the most complicated structures in all of mathematics—is a table with more than 200 billion entries. Printed out on a paper, it would cover all of Manhattan. Scientists hope to use the map to simplify calculations and help them understand the universe. [Jessica Ruvinsky]

Crust formed early in Earth's history Geologists took a new look at a sequence of old rocks in southwest Greenland and discovered the earliest example yet of plate tectonics. Until March, when the findings were published in *Science*, researchers thought that continents began to solidify on Earth around 2.5 billion years ago. The new discovery shows that the process started much sooner, closer to when the planet formed. Earth scientists have been crawling over the intensely baked and contorted rocks of the 3.8-billion-year-old Isua Supra-crustal Belt for decades. But when two Norwegian scientists walked over the Greenland outcrops, bells went off. They saw sheeted dikes—thinly banded rocks composed almost entirely of a shiny, green-black mineral called amphibole. Previously, researchers had found nearby pillow lavas—bulbous lava flows that form under water. The combination of the two rock types, plus other clues, could mean only one thing: They were standing on an ancient piece of the ocean floor. The significance of the find hit them immediately: It meant that the ocean floor was forming, and the plate tectonics was active, nearly 1.3 billion years earlier than previously thought. It's rare for such ocean rocks to survive so long, and finding them isn't easy. [Anne Sasso]

Saturn seen in new light Delivering more than just pretty pictures, the Cassini spacecraft returned an impressive collection of photographic firsts of Saturn and its environs in 2007. They include views of an improbable hexagonal feature containing a huge system of swirling clouds at the planet's north pole, as well as never-before-seen views of the top and bottom of Saturn's rings. The origin of the hexagon—so large that two Earths could be lined up across its diameter—is a mystery. "Clouds circulate around the feature like cars on a racetrack," commented a planetary scientist at NASA's Jet Propulsion Laboratory. Studying this formation may give us a better idea of how fast Saturn rotates on its axis—a measurement that is difficult to make because of the planet's fast winds. The latest images of Saturn's rings, which show propeller-shaped clumps and moonlets shattered by an ancient impact, are also giving astronomers a lot to think about. The ring pictures may help them figure out how Earth formed: If we understand how icy particles in the outer solar system behave, then we can refine our understanding of how the early solar system formed from that same material. [Boonsri Dickinson]

Birds' inner compass Having previously found that molecules called cryptochromes embedded in birds' retinas both respond to light and detect magnetic fields, scientists in Germany recently showed that avian brains incorporate clever mechanisms for processing the geomagnetic information. By using tracer chemicals in experiments with live garden warblers, the researchers followed a circuit of neurons from the cryptochrome molecules to the "cluster N" area of the brain, which is active during navigation, showing for the first time that cluster N uses information from the retina. Scientists aren't sure how such compass directions appear in the eyes of migratory birds, but they guess that "If a bird looks north or south, it somehow has a light spot or a dark spot there." Another navigational tool: the birds' beaks, which contain bits of magnetite, a mineral that may allow them to sense Earth's magnetic field. Since the field is stronger near the poles, the magnetite gives birds crucial information about their latitude. [Eli Kintisch]